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<p>(54) Title: PACKAGE HAVING A MULTIPLE-FILM LID COMPRISING A GAS-IMPERMEABLE FILM PEELABLY ADHERED TO A GAS-PERMEABLE FILM</p>		
<p>(57) Abstract</p> <p>A method and package which allows for butchering and packaging of fresh red meat at a centralized facility is provided. The package includes a substantially gas-impermeable tray supporting a product, a first permeable and/or perforated film sealed to the tray for enclosing the product, and a second substantially gas-impermeable film enclosing the first film, such that removal of said substantially gas-impermeable film provides for the exchange of gases into and out of the package. One of either the first or second films has been corona treated and the two films are pressed together to form a laminate. The laminate is sealed to the tray such that the first film is sealed to the tray and the second film is peelably sealed to the first film.</p>		

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**PACKAGE HAVING A MULTIPLE-FILM LID COMPRISING A
GAS-IMPERMEABLE FILM PEELABLY ADHERED TO A
GAS-PERMEABLE FILM**

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BACKGROUND OF THE INVENTION

The present invention relates to packaging for products, such as food products, which are enclosed under certain environmental conditions in a support member having a lid which peelably delaminates (i.e., delaminates upon peeling) to expose a gas-permeable film, thereby causing a change in the environmental conditions within the package. More specifically, the 10 invention relates to such packaging for fresh red meat products.

Historically, large sub-primal cuts of meat have been butchered and packaged in each supermarket. This arrangement has long been recognized to be inefficient and expensive. It would instead be preferable to butcher and package the meat at a central processing facility which benefits from economies of scale, and then ship the packaged meat to individual 15 supermarkets or other retail outlets such as is done, for example, with many poultry products. It is believed that central processing of meat would also lead to a higher quality, more sanitary product with a longer shelf-life than meat which is butchered and packaged in individual supermarkets.

Fresh red meat presents a particular challenge to the concept of centralized processing 20 and packaging due to its oxygen-sensitivity. Such oxygen-sensitivity is manifested in the shelf-life and appearance (color) of a packaged meat product. For example, while a low-oxygen packaging environment generally increases the shelf-life of a packaged meat product (relative to meat products packaged in an environment having a higher oxygen content), red meat has a tendency to assume a purple color when packaged in the absence of oxygen or in an environment 25 having a very low oxygen concentration, i.e., below about 5% oxygen. Unfortunately, such a purple color is undesirable to most consumers, and marketing efforts to teach the consumer about the acceptability of the purple color have been largely ineffective. When meat is exposed to a sufficiently high concentration of oxygen, e.g., as found in air, it assumes a bright red color which most consumers associate with freshness. After 1 to 3 days of such exposure, however, 30 meat assumes a brown color which, like the purple color, is undesirable to most consumers (and indicates that the meat is beginning to spoil).

Thus, in order to effectively butcher and package meat products in a central facility for distribution to retail outlets, the meat would desirably be packaged, shipped, and stored in a low-oxygen environment for extended shelf-life, and then displayed for consumer sale in a relatively

high-oxygen environment such that the meat is caused to "bloom" into a red color just before being placed in a retail display case. While in the retail display case, the meat product is desirably contained in a package which protects it from microbial and other contamination. In order to attain the maximum economic benefit from centralized packaging, the package in which the meat product is displayed for consumer sale is the same package in which the meat product is initially packaged and shipped from the central processing facility. As can be appreciated, centralized butchering and packaging of fresh red meat presents a number of difficult packaging challenges.

A variety of packages have been developed in an effort to overcome the foregoing challenges. One attempted solution is to use a dual-film cover or lid over a support member, such as an oxygen-barrier tray, which contains the meat product. The support member generally includes a cavity, in which the product is contained, surrounded by a peripheral flange to which the lid is secured. One film of the dual-film lid is relatively oxygen-impermeable, i.e., provides a substantial barrier to the passage of oxygen therethrough, and is removably positioned above a second film that is relatively oxygen-permeable, i.e., sufficiently permeable to the passage of oxygen to allow the packaged meat product to bloom. Thus, the package may be shipped with the upper, impermeable film intact so that a low-oxygen environment may be maintained within the package during shipping. Then the impermeable film may be removed at the supermarket just prior to placing the package in a retail display case. Since the lower film is oxygen permeable, it allows the meat product to bloom in the presence of oxygen which enters the package from the ambient atmosphere.

Conventional dual-film packaging arrangements can employ either separate, discrete permeable and impermeable lids which are attached separately to the support member, or a single, peelable lid which may delaminate into permeable and impermeable films. With the separate film approach, the permeable and impermeable lids are typically sealed to separate locations on the support member flange, with the permeable lid being sealed to an inner periphery of the flange and the impermeable lid being sealed to an outer periphery of the flange, i.e., outboard of the flange area at which the permeable lid is sealed. One drawback of this approach is the difficulty of sealing two separate lids to a conventional, single-flange tray in an automated fashion, i.e., continuously from separate permeable and impermeable webs of film. The permeable lid must be applied to the tray flange from a continuous web, secured (e.g., heat-welded) to an inner periphery of the flange, and then severed from the web in such a manner as to leave a sufficient area on an outer periphery of the flange to which the impermeable lid can be secured and severed from a continuous web of an impermeable film. Since this approach

involves two separate lidding operations, it entails a relatively complex and expensive packaging procedure (as compared to a single-lid packaging operation). For example, it is difficult to sever the permeable lid from the web in such a manner that sufficient room is left on the outer periphery of the flange to provide a sealing surface for the impermeable lid without damaging the 5 outer flange periphery. It is also difficult to completely remove atmospheric oxygen from the space between the permeable and impermeable lids.

While single, peelable lids have the advantage of providing a single web for sealing to a conventional tray flange, such films often fail during peeling, with the impermeable film either being difficult to delaminate from the permeable film or with all or part of the permeable film 10 remaining bonded to the impermeable film and tearing away from the rest of the package, thereby resulting in tears or holes in the package which expose the packaged meat product to dirt or contamination. The bond which is formed between the films must be strong enough to prevent film separation during shipping and storage so that oxygen does not prematurely enter the package via the gas-permeable film (i.e., prior to the time when the retail worker intentionally 15 peels the impermeable film from the permeable film). At the same time, the bond between the two films must provide sufficient peelability that the two films can be separated without tearing or otherwise compromising the permeable film as noted above. As can be readily appreciated, these are difficult and somewhat conflicting requirements to meet.

The primary difficulty in achieving consistent and reliable peelability in a single, 20 peelable lid lies in the manner in which the permeable and impermeable films are adhered to one another. Conventional mechanisms for bonding two films together generally include the use of heat and pressure (thermal lamination) and/or adhesives (adhesive lamination) to bond the two films. While such mechanisms work well in producing non-peelable laminates (i.e., laminates which are not intended to be subsequently delaminated), they are not readily adaptable for 25 producing peelable laminates. For example, when using thermal and/or adhesive lamination techniques, it is difficult to regulate the resultant bond-strength between the laminated films in such a manner that the films will peelably delaminate when subjected to a desired peel force. In addition, and as discussed more fully below, thermal and adhesive lamination is disadvantageous when the gas-permeable film is perforated because the heat from thermal lamination can weld 30 closed the perforations while adhesive can occlude the perforations.

Accordingly, there is a need in the art for a dual-film package which combines the manufacturing simplicity of a package having a single, peelable lid with the consistent peelability of a package having separate permeable and impermeable lids.

SUMMARY OF THE INVENTION

- That need is met by the present invention which is directed to a package, comprising:
- a product support member having a cavity formed therein, a product being disposed with the cavity;
- 5 a laminate heat-sealed to the support member and enclosing the product therein, the laminate comprising a first film in contact with the support member and a second film, at least one of the first and second films comprising a reactively-modified surface such that the laminate peelably delaminates at a peel force ranging from 0.001 pounds per inch to 2.5 pounds per inch.
- The present invention is also directed to providing a method for making a package for a
- 10 product comprising:
- providing a product support member containing a product therein;
 - providing a first film;
 - providing a second film;
 - reactively modifying the surface of at least one of the first and second films to form a corona

15 treated surface and pressing the first and second films together, thereby forming a laminate which is delaminatable at a peel force ranging from 0.001 pounds per inch to 2.5 pounds per inch;

 - extending the laminate over the support member containing the product such that the first film is adjacent to the support member; and
 - sealing the laminate to the support member.
- 20 The first film is preferably gas-permeable and, more preferably, perforated to provide for rapid penetration of atmospheric oxygen therethrough. The first and/or second film surface is preferably reactively modified via corona treatment.
- By laminating the permeable and impermeable films via corona treatment or other reactive surface modification technique, the present invention provides a reliable peel mechanism for a
- 25 package having a dual-film lid which combines the manufacturing simplicity of a package having a single, peelable lid with the consistent peelability of a package having separate permeable and impermeable lids. Furthermore, the disadvantages of thermal and adhesive lamination are avoided. This is particularly important when the gas-permeable first film is perforated.

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BRIEF DESCRIPTION OF THE DRAWINGS

A detailed description of preferred embodiments of the invention follows, with reference to the accompanying drawings, wherein:

Fig. 1 is a perspective view of a package, according to the invention;

Fig. 2 is a partial cross-sectional view of the package of Figure 1; and

Fig. 3 is a diagrammatic illustration of the process for making a laminate in accordance with the present invention.

DEFINITIONS

As used herein, the term "film" refers to a thermoplastic material, generally in sheet or web form, having one or more layers of polymeric or other materials which may be bonded together by any suitable means well known in the art, e.g., coextrusion, lamination, etc. A film can be a monolayer film (having only one layer), or a multilayer film (having two or more layers).

As used herein, the term "laminate" refers to a composite structure of two or more films which are bonded together. Generally, the component films of a laminate may be bonded together by any suitable means such as, e.g., adhesive bonding, corona treatment, heat treatment, pressure treatment, etc., including combinations thereof. Laminates in accordance with the present invention are formed by pressing together two or more films of which at least one has been corona treated. The surface (or surfaces) of each of the films at which bonding occurs is referred to herein as the "bonding surface." The plane or contour at which two films intersect is referred to herein as an "interface."

As used herein, the term "layer" refers to a discrete film component which is coextensive with the film and has a substantially uniform composition. In a monolayer film, the "film" and "layer" would be one and the same.

As used herein, the phrases "reactive surface modification," "reactively modifying the surface of," "reactively-modified surface" and the like refer to chemically altering the surface of a film in order to incorporate reactive species onto such film surface, e.g., to provide the film surface with auto-adhesion functionality (i.e., rendering the surface capable of adhering to another surface without the need for an adhesive). Specific examples of reactive surface modification include corona treatment, plasma (ionized gas) treatment, and flame treatment, with corona treatment being preferred. The surface of a film which has been subjected to reactive surface modification is referred to as a "modified surface" or, in the case of corona treatment, a "corona treated surface."

As used herein, the phrase "gas-permeable" refers to a film or film portion which admits at least about 1,000 cc of gas, such as oxygen, per square meter of film per 24 hour period at 1 atmosphere and at a temperature of 73°F (at 0% relative humidity). More preferably, a gas-permeable film or film portion admits at least 5,000, even more preferably at least 10,000, such as at least 15,000, 20,000, 25,000, 30,000, 35,000, 40,000, and 50,000, and most preferably at least 100,000 cc of oxygen per square meter per 24 hour period at 1 atmosphere and at a temperature of 73°F (at 0% relative humidity). Typical gas transmission rates for gas-permeable

film and film portions in accordance with the present invention range from 1,000 to 100,000, preferably 5,000 to 95,000, such as 10,000 to 90,000, 15,000 to 85,000, 20,000 to 80,000, 25,000 to 75,000, 30,000 to 70,000, and 40,000 to 60,000 cc of oxygen per square meter per 24 hour period at 1 atmosphere and at a temperature of 73°F (at 0% relative humidity). In

5 accordance with the present invention, a gas-permeable film or film portion can itself have the aforescribed levels of gas permeability or, alternatively, can be a film or film portion which does not inherently possess the aforescribed levels of gas permeability but which is altered, e.g., perforated or peelably delaminated, to render the film gas- permeable as defined above.

As used herein, the phrase "substantially gas-impermeable" refers to a film or film
10 portion which admits less than 1000 cc of gas, such as oxygen, per square meter of film per 24 hour period at 1 atmosphere and at a temperature of 73°F (at 0% relative humidity). More
preferably, a substantially gas-impermeable film admits less than about 500, such as less than
300, and less than 100 cc of gas, more preferably still less than about 50 cc, and most preferably
less than 25 cc, such as less than 20, less than 15, less than 10, less than 5, and less than 1 cc of
15 gas per square meter per 24 hour period at 1 atmosphere and at a temperature of 73°F (at 0%
relative humidity).

As used herein, the phrase "product support member" refers to a component of a
package on or in which a product is disposed. Meat products are typically disposed in a tray-like
20 package component comprising, e.g., expanded polystyrene sheet material which has been
thermoformed into a desired shape, for supporting the meat product. A product support member
preferably includes a cavity into which the product is disposed and a peripheral flange which
provides a sealing surface for attachment of a lid to the support member to thereby enclose the
product within the cavity.

As used herein, the term "bond-strength" refers generally to the adhesive force with
25 which two adjacent films, or two adjacent film layers, are connected, and is measured by the
force required to separate two films or film layers in accordance with ASTM F88-94.

As used herein, the terms "peel," "peeling," and the like refer to the act of removing one
or more films from a multiple-film laminate by manually grasping and pulling back the film(s)
along a plane or interface between two films in the laminate.

30 As used herein, the term "peel-force" refers to the amount of force required to separate
two films of a multiple-film laminate, and is measured in accordance with ASTM F904-91.

As used herein, the term "heat-seal" refers to the union of two films by bringing the
films into contact, or at least close proximity, with one another and then applying sufficient heat
and pressure to a predetermined area (or areas) of the films to cause the contacting surfaces of

the films in the predetermined area to become molten and intermix with one another, thereby forming an essentially inseparable bond between the two films in the predetermined area when the heat and pressure are removed therefrom and the area is allowed to cool.

As used herein, the phrase "sealant film" refers to a film which is conformably bonded to at least one of the exterior surfaces of a product support member. Preferably, the sealant film is bonded to the upper, as opposed to the lower, exterior surface of the support member and is a substantially gas-impermeable film.

As used herein, the phrase "ethylene/alpha-olefin copolymer" generally designates copolymers of ethylene with one or more comonomers selected from C₃ to C₂₀ alpha-olefins, such as 1-butene, 1-pentene, 1-hexene, 1-octene, methyl pentene and the like, in which the polymer molecules comprise long chains with relatively few side chain branches. These polymers are obtained by low pressure polymerization processes and the side branching which is present will be short compared to non-linear polyethylenes (e.g., LDPE, a low density polyethylene homopolymer). Ethylene/alpha-olefin copolymers generally have a density in the range of from about 0.86 g/cc to about 0.94 g/cc. The term linear low density polyethylene (LLDPE) is generally understood to include that group of ethylene/alpha-olefin copolymers which fall into the density range of about 0.915 to about 0.94 g/cc. Sometimes linear polyethylene in the density range from about 0.926 to about 0.94 is referred to as linear medium density polyethylene (LMDPE). Lower density ethylene/alpha-olefin copolymers may be referred to as very low density polyethylene (VLDPE, typically used to refer to the ethylene/ butene copolymers available from Union Carbide with a density ranging from about 0.88 to about 0.91 g/cc) and ultra-low density polyethylene (ULDPE, typically used to refer to the ethylene/octene copolymers supplied by Dow).

The phrase "ethylene/alpha-olefin copolymer" also includes homogeneous polymers such as metallocene-catalyzed EXACT™ linear homogeneous ethylene/alpha-olefin copolymer resins obtainable from the Exxon Chemical Company, of Baytown, Texas; TAFMER™ linear homogeneous ethylene/alpha-olefin copolymer resins obtainable from the Mitsui Petrochemical Corporation; and long-chain branched, metallocene-catalyzed homogeneous ethylene/alpha-olefin copolymers available from The Dow Chemical Company, known as AFFINITY™ resins. The phrase "homogeneous polymer" refers to polymerization reaction products of relatively narrow molecular weight distribution and relatively narrow composition distribution. Homogeneous polymers are structurally different from heterogeneous polymers (e.g., ULDPE, VLDPE, LLDPE, and LMDPE) in that homogeneous polymers exhibit a relatively even sequencing of comonomers within a chain, a mirroring of sequence distribution in all chains, and a similarity of

length of all chains, i.e., a narrower molecular weight distribution. Furthermore, homogeneous polymers are typically prepared using metallocene, or other single-site type catalysts, rather than using Ziegler-Natta catalysts. Such single-site catalysts typically have only one type of catalytic site, which is believed to be the basis for the homogeneity of the polymers resulting from the
5 polymerization.

As used herein, the term "ethylene vinyl acetate copolymer" or "EVA" is used to refer to a copolymer formed from ethylene and vinyl acetate monomers wherein the ethylene derived units in the copolymers are present in major amounts, preferably between about 60% and 98% by weight and the vinyl acetate derived units in the copolymer are present in minor amounts, preferably between about
10 2% and 40% by weight.

As used herein, the term "olefin" generally refers to any one of a class of monounsaturated, aliphatic hydrocarbons of the general formula C_nH_{2n} , such as ethylene, propylene, and butene. The term may also include aliphatics containing more than one double bond in the molecule such as a diolefin or diene, e.g., butadiene.

As used herein, the term "polyolefin" refers to olefin polymers and copolymers, especially ethylene and propylene polymers and copolymers, and to polymeric materials having at least one olefinic comonomer, such as ethylene vinyl acetate copolymer and ionomer.
15 Polyolefins can be linear, branched, cyclic, aliphatic, aromatic, substituted, or unsubstituted. Included in the term polyolefin are homopolymers of olefin, copolymers of olefin, copolymers of
20 an olefin and a non-olefinic comonomer copolymerizable with the olefin, such as vinyl monomers, modified polymers of the foregoing, and the like. Modified polyolefins include modified polymers prepared by copolymerizing the homopolymer of the olefin or copolymer thereof with an unsaturated carboxylic acid, e.g., maleic acid, fumaric acid or the like, or a derivative thereof such as the anhydride, ester metal salt or the like. It could also be obtained by
25 incorporating into the olefin homopolymer or copolymer, an unsaturated carboxylic acid, e.g., maleic acid, fumaric acid or the like, or a derivative thereof such as the anhydride, ester metal salt or the like.

As used herein, a "styrene butadiene copolymer" (SBC) refers to a thermoplastic copolymer, generally a block copolymer, containing styrene comonomer and butadiene
30 comonomer.

As used herein, the term "oriented" or "stretch-oriented" refers to a polymer-containing material which has been stretched at an elevated temperature (the orientation temperature), followed by being "set" in the stretched configuration by cooling the material while substantially retaining the stretched dimensions. A material can be stretched in one direction (uniaxial orientation), two

directions (biaxial orientation), or multiple directions. Biaxial orientation typically occurs in two directions which are perpendicular to one another, such as the longitudinal direction and the transverse direction.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is directed to a tray-type package suitable for the central processing of fresh red meat which includes a substantially gas-impermeable support member or tray, a first film sealed to the tray which is gas-permeable or which includes a means defined therein for providing for an exchange of gases into and out of the package, and a substantially gas-impermeable film which encloses the first film. The package most preferably contains a low oxygen gaseous atmosphere such as, for example, a nitrogen/carbon dioxide mix. Thus, removal of the substantially gas-impermeable film allows for a release of the low oxygen atmosphere and for introduction of oxygen to the packaged meat product.

The means for exchanging gases defined within the first film are preferably perforations defined within the first film which are exposed upon removal of the substantially gas-impermeable film. Although films which are highly gas-permeable as a result of the specific component resins are within the scope of the first film of the present invention, it is preferred that the first film is perforated. Most preferred are gas-permeable films which are also perforated for improved permeability.

Figures 1 and 2 illustrate a package having a multiple-film lid which may be delaminated into a substantially gas-impermeable upper film and a perforated lower film. Such multiple-film lids allow for a simplified packaging operation employing conventional single flange trays, a vacuum or, preferably, a vacuum and gas flush with a low oxygen atmosphere, and sealing of a single web to the tray flange in a single sealing step. At retail, the upper film of the lid is peeled away revealing a perforated lower film which preferably has a gas transmission rate of at least about 50,000 cc/m²/24 hrs./atm. at 73°F, allowing for a rapid release of the low oxygen atmosphere and introduction of oxygen for immediate blooming of the packaged meat product.

Looking to Figure 1, a package 10 in accordance with the present invention includes a support member or tray 12 having side walls 14 and a base 16 defining an inner cavity 18 for receiving product 20. A peripheral flange 22 is defined about the upper portions of side walls 14. Multiple-film (laminate) lid 26 is sealed to the tray at the flange 22.

Figure 2 is a partial cross-section of the package 10 of Figure 1. Lid 26 is a laminate of a nonperforated substantially gas-impermeable film 28 and a film 30 which includes perforations 32 defined therein. It is preferred that film 30 is a gas-permeable film because, although the perforations defined therethrough greatly increase the gas transmission rate of the film, such inherent permeability

aids in gas exchange and blooming will be hindered in areas of intimate film to meat contact. However, a nonpermeable film which is perforated to render it permeable is also within the scope of the present invention. As is shown in Figure 2, nonperforated film 28 is peeled away to reveal perforated film 30 for a rapid exchange of gases and blooming of the packaged meat at retail.

5 Perforations 32 preferably range from about 5 to about 250 microns in diameter, more preferably 25 to 125 microns, and most preferably 75 to 100 microns in diameter. Ideally, the perforations are large enough to permit the passage of atmospheric gas therethrough (oxygen, nitrogen, carbon dioxide), but small enough to prevent the passage of liquids or dirt. The perforations may be formed by any suitable means, including the use of mechanical, chemical, or
10 electrical devices. Non-limiting examples of such devices include those which perforate with laser energy, electrostatic discharge, ultrasonic waves, flame discharge, needles or other sharp objects, or combinations thereof. Preferred devices are those which produce laser energy or electrostatic discharge. An electrostatic discharge device operates by passing a film between a pair of electrodes and transmitting electricity to one of the electrodes in sufficient voltage that the
15 electrode discharges through the film and to the other electrode, thereby perforating the film.

It is preferred that laminate 26 is formed by reactive surface modification of films 28 and/or
30. More preferably, laminate 26 is formed by corona lamination. Specifically, when first film 30 includes perforations 32, corona lamination (or other form of reactive surface modification) is preferred to either adhesive lamination, wherein the adhesive may occlude the perforations, or
20 lamination under heat and pressure, wherein heat sufficient to weld the two films may partially or completely close the perforations by melt deformation. Corona lamination may be employed to form a laminate which is delaminatable at any desired peel force, depending on the component resins of the adjacent bonding layers of the films being laminated and the degree of corona discharge exposure (which is, in turn, determined by the amount of power supplied to the corona unit and the speed at
25 which the film being treated passes through the corona unit). For purposes of the present invention, in order to ensure that film 28 may be pealably removed from film 30, the bond strength between the two films should be such that a peel force of no more than about 2.5 lb/inch is required to delaminate the two films. In fact, a weak bond, such as one representing a peel force as low as about 0.001 lb/inch, is sufficient to keep the films together during the manufacture of the package. That is, generally, the
30 present inventive package is made by providing a tray containing a product, providing films 30 and 28, corona treating at least one of the two films, pressing them together to form laminate 26, extending laminate 26 over the tray such that film 30 is directly adjacent to the tray, and sealing the laminate to the tray. A bond strength falling within these ranges provides a balance between sufficient adhesion to prevent premature separation of film 28 from film 30, e.g. during manufacture, shipping and storage,

and sufficient peelability so that the film 28 can be separated from film 30 without tearing or otherwise compromising film 30. A bond strength of more than 2.5 lb/inch results in a lid that is more difficult to peel, or can result in unintentional separation of the entire laminate from the tray. On the other hand, a bond strength of less than about 0.001 lb/inch creates a greater likelihood of premature separation of film 28 from film 30.

Figure 3 diagrammatically illustrates the process for forming laminate 26 in accordance with the present invention. For the embodiment illustrated, film 30 is passed through electrostatic microperforation device 50 such as discussed above. Film 28 is passed through corona treatment unit 52. It should be noted that film 30 may be corona treated instead of film 28 or, most preferably, the bonding surfaces of both films 28 and 30 are subjected to corona treatment.

Within unit 52, the bonding surface of film 28 and/or 30 is subjected to corona discharge. The amount of corona discharge to which the films are exposed is directly proportional to the amount of power supplied to the corona unit and also the speed at which the films are passed through the unit. Any desired combination of power input to the corona unit and film speed may be employed to achieve a desired bond-strength between the films. The amount of power to supplied to the corona unit may range, e.g., from about 0.02 to about 0.5 kilowatts (kw) per inch of film width and the film speed through the corona unit may range, e.g., from about 10 to about 2000 feet/minute. Corona treatment units are commercially available, e.g., from Enercon Industries Corporation of Menomonee Falls, WI.

By one theory, a high voltage passed through an electrode adjacent to the film surface ionizes the air, causing oxidation of the corona-treated film surface. Although a variety of theories have been suggested to explain corona lamination bonding of polyolefins, it is widely recognized that corona treatment of polymeric materials can improve adherence characteristics under certain circumstances. Preferably, films 28 and 30 are then immediately pressed together at rolls 54 and taken up as laminate 26.

Although not shown in Figure 3, it should be noted from the Examples below that the laminate of the present invention may include three or more component films. Such may be desirable, for example, when film 30 includes therein an anti-fog additive. That is, in order to prevent the accumulation of condensation on the inside surface of film 30 from the packaged food product, it is preferred that film 30 include an anti-fog additive therein. Suitable anti-fog additives include, e.g., polyethoxylated cetyl alcohol, glycerol monostearate, polyoxyethylene (4) nonylphenol, glycerol monooleate, polyoxy ethylene (4) lauryl alcohol, polyoxy ethylene (26) glycerol ether, and polyoxy ethylene (20) sorbitol ether. The inclusion of anti-fog additives in a film, however, has been found to result in weak corona bond between the anti-fog-containing film and another film. Although it may be possible to compensate for the weakness of the bond by increasing the amount of exposure to the

corona discharge (by increasing the amount of corona discharge and/or slowing the speed at which the film passes by the corona electrode), such measures may often be too costly and time-consuming for commercial production.

The inventors have discovered that the detrimental effects of an anti-fog additive on corona bond-strength can be substantially reduced by the inclusion of an intermediate film between the two films which are desired to be bonded, wherein the intermediate film contains no anti-fog additive and wherein both the intermediate film and the anti-fog-containing film are formed from, or include exterior layers at the interface of the two films which are formed from, materials which have a high affinity for one another when subjected to corona treatment ("interface materials"). If both the intermediate film and the anti-fog-containing film are stretch-oriented films, almost any polyolefin or blend of polyolefins may be employed at the interface of the two films as the interface materials. In this regard, the polyolefin may be the same or different in each of the films. If one or both of the films is not stretch-oriented (but is, instead, a hot blown film, for example), it becomes more difficult to obtain a good corona bond between such films. The inventors have determined, however, that a good corona bond can still be obtained if the interface material of the non-oriented film(s) includes at least one material selected from the group consisting of ethylene/vinyl acetate copolymer (EVA), ethylene/methacrylate copolymer (EMA), acrylic acid copolymers, methyl acrylic acid copolymers, acrylic acid-modified EVA or EMA, anhydride-modified EVA or EMA, and syndiotactic polymethyl pentene. If one of the films is stretch-oriented and the other is not, the oriented film may include any polyolefin as the interface material. If both films are not stretch-oriented, the interface materials for both films are preferably selected from the above list in order to form a good corona bond.

Accordingly, the strength of the corona bond between the two films is improved despite the presence of anti-fog additive in one of the films. Thus, when an anti-fog additive is included in film 30, it is preferred that a third, intermediate film be included between films 28 and 30. The intermediate film may, if desired, have the same composition as film 30 except that the intermediate film would not contain anti-fog additive. This approach is demonstrated in Examples 6 and 8 below. Since the intermediate film contains no anti-fog additive, it forms a strong corona bond with the film 28 which also contains no anti-fog additive. In general, the bond between the intermediate film and film 28 will be stronger than the bond between the intermediate film and film 30 when film 30 contains an anti-fog additive. Thus, when laminate 26 is caused to be peelably delaminated, both film 28 and the intermediate film will be removed from package 10, leaving behind only film 30.

The intermediate film may have any desired film thickness, e.g., ranging from about 0.3 mil to about 5 mils and, more preferably, from about 0.5 mil to about 1 mil.

Another reason to include an intermediate film in laminate 26 is to provide a relatively symmetrical laminate structure which precludes curling, such as is set forth below in Example 5.

For any three-film laminates, all four bonding surfaces are preferably simultaneously corona treated and all three films are then immediately and simultaneously pressed together; although, less preferably, a first corona laminate may be formed and then its bonding surface may be simultaneously corona treated with the bonding surface of a third film and the laminate and film pressed together.

Referring again to FIG. 3, rolls 54 are preferably heated in order to improve bonding between the two films. By such process, laminate 26 is formed by a combination of corona lamination and thermal lamination. However, for the examples given below it should be noted that at least one of the 10 films employed in forming the final laminate is a stretch-oriented, heat shrinkable film. Thus, for such embodiments care should be taken to insure that the temperature of the nip rolls is sufficiently lower than the orientation temperature of the heat shrinkable film in order to preclude shrinkage of that film during manufacture of the laminate.

Also optionally, a thin layer of an adhesive may be applied to the bonding surface of one of the 15 films of the laminate such that laminate 26 would be formed by a combination of corona lamination and adhesive lamination. Also, a combination of corona, adhesive, and thermal lamination may be employed if desired.

The gas-permeable film or web of the present invention is an oxygen permeable film which may be a formable or stretchable material. Typical polymeric materials for the gas-permeable film 20 may include any material which can be securely sealed and bonded to the support member, such as polyethylene or any of a variety of ethylene copolymers including, for example, ethylene vinyl acetate (EVA), ethylene/acrylate copolymers, ethylene/acrylic acid copolymers including metal neutralized salts thereof, and ethylene/alpha-olefin copolymers such as, e.g., linear low density polyethylene (LLDPE).

25 A preferred gas-permeable film for use in accordance with the present invention is a symmetrical, five layer oriented film having the structure:

EVA / LLDPE / EVA / LLDPE / EVA,

although a wide variety of gas-permeable films may be employed. The gas-permeable film may have any desired thickness ranging, e.g., from about 0.3 mil to about 5 mils and, more preferably, from 30 about 0.5 mil to about 1 mil.

The substantially gas-impermeable film or web of the present invention may be any suitable barrier layer, film or laminate which is substantially impermeable to gas such as oxygen so that a fresh meat product contained in a vacuum or other low oxygen atmosphere possesses an enhanced shelf life over a package without the barrier layer. Suitable polymeric materials having gas barrier properties

- for use in the present invention include ethylene/vinyl alcohol copolymers, polyamides, vinylidene chloride copolymers (PVDC) such as vinylidene chloride/vinyl chloride copolymer or vinylidene chloride/methyl acrylate copolymer. Laminates of a sealable film and a barrier structure which includes a barrier layer and a tough, non-forming material such as a biaxially oriented nylon or
- 5 biaxially oriented polyester are especially preferred for use as the substantially gas-impermeable lidding of the present inventive packages. A preferred substantially gas-impermeable web is SiO_x-coated PET such as that sold under the tradename Simplicity (TM) by PC Materials of Mount Bethel, Pa. ("SiO_x" is a silicon oxide where "x" typically ranges from 0.5 to 4. The SiO_x coating on the PET or other substrate generally has a thickness ranging from about 50 to about 2000 angstroms.)
- 10 Also preferred is PVDC-coated PET, wherein the PVDC coating typically ranges in thickness from about 1 to about 10 microns. A variety of other laminates and multilayer films may also be employed as the substantially gas-impermeable web of the present invention.

Generally, the films or webs which may be employed in accordance with the present invention may be monolayer or multilayer. Multilayer films may be employed when all of the properties required of the film cannot be achieved by a single polymeric component or a blend of polymers in a single layer. For example, a substantially gas-impermeable film to be sealed to a tray in all likelihood will comprise a multilayer film because several properties are needed including peelable sealability, as well as oxygen barrier, impact, and outer abuse properties. Laminates of sealable films and nonforming materials such as biaxially oriented polyester or biaxially oriented nylon are also within

15 20 the scope of the present invention and are widely recognized as superior lidstocks for tray-type packages.

In order for the gas-permeable and gas-impermeable films to be corona bonded with a desired bond-strength as discussed above (i.e., such that the films may be peelably delaminated a peel force ranging from about 0.001 to about 2.5 lb/inch), it is preferred that the materials from which the films are formed, or their exterior layers located at the interface of the two films, are materials which have a high affinity for one another when subjected to corona treatment ("interface materials"). If both the gas-permeable and gas-impermeable films are stretch-oriented films, almost any polyolefin or blend of polyolefins may be employed at the interface of the two films as interface materials. The polyolefin may be the same or different in each of the films. If one or both of the films is not stretch-oriented (but

25 30 is, instead, a hot blown film, for example), it is preferred that the interface material of the non-oriented film(s) includes at least one material selected from the group consisting of ethylene/vinyl acetate copolymer (EVA), ethylene/methacrylate copolymer (EMA), acrylic acid copolymers, methyl acrylic acid copolymers, acrylic acid-modified EVA or EMA, anhydride-modified EVA or EMA, and syndiotactic polymethyl pentene. If one of the films is stretch-oriented and the other is not, the oriented

film may include any polyolefin as the compatible interface material. If both films are not stretch-oriented, the interface materials for both films are preferably selected from the above list in order to form a good corona bond.

In another preferred embodiment of the invention, both the gas-permeable and gas-impermeable films contain exterior layers which are in contact with another at the interface between the two films and which comprise a styrene/butadiene copolymer (SBC). As described in Examples 10, 11, and 12, the SBC-containing layers thus form the peelable interface between the two films.

Preferably, a sealant film is included as a liner for at least the upper surface of support member 12 as a means to improve the functional characteristics of the support member when such improvement is deemed necessary or desirable. For example, if the support member is constructed of a material which is not sufficiently gas-impermeable for the intended package application, a sealant film which provides the required degree of gas-impermeability may be employed. A sealant film may also be used to improve the bond-strength between the gas-permeable film and support member when the film and support member are constructed of materials which are not readily capable of forming a sufficiently strong heat-seal. In that case, a sealant film may be used which both bonds well to the upper surface of the support member and also forms a strong heat-seal with the gas-permeable film.

Support member 12 can have any desired configuration or shape, e.g., rectangular, round, oval, etc. Similarly, flange 22 may have any desired shape or design, including a simple, substantially flat design which presents a single sealing surface as shown, or a more elaborate design which presents two or more sealing surfaces, such as the flange configurations disclosed in U.S. Patent Nos. 5,348,752 and 5,439,132, the disclosures of which are hereby incorporated herein by reference. The flange may also include a peripheral lip positioned adjacent and exterior to the heat-sealing surface to facilitate the peelable delamination of lid 26, such as disclosed in U.S. Serial No. 08/733,843, entitled PACKAGE HAVING PEEL INITIATION MECHANISM and filed October 18, 1996, the disclosure of which is hereby incorporated herein by reference.

Suitable materials from which support member 12 can be formed include, without limitation, polyvinyl chloride, polyethylene terephthalate, polystyrene, polyolefins such as high density polyethylene or polypropylene, paper pulp, nylon, polyurethane, etc. The support member may be foamed or non-foamed as desired, and preferably provides a barrier to the passage of oxygen therethrough, particularly when the packaged food product is oxygen-sensitive (i.e., perishable, degradable, or otherwise changeable in the presence of oxygen), such as fresh red meat products (e.g., beef, veal, lamb, pork, etc.), poultry, fish, cheese, fruits, or

vegetables. When such oxygen-sensitive products are to be packaged, support member 12 preferably allows less than or equal to about 500 cc of oxygen to pass, more preferably less than about 100 cc of oxygen, more preferably still less than about 50 cc, and most preferably less than about 25 cc of oxygen to pass per square meter of material per 24 hour period at 1
5 atmosphere and at a temperature of 73°F (at 0% relative humidity). Support member 12 may be formed from a material which itself provides a barrier to the passage of oxygen, e.g., vinylidene chloride copolymer, nylon, polyethylene terephthalate, ethylene/vinyl alcohol copolymer, etc. Alternatively, support member 12 may have a substantially gas-impermeable sealant film
laminated or otherwise bonded to the inner or outer surface thereof as described above, and as
10 also disclosed in U.S. Patent Nos. 4,847,148 and 4,935,089, and in U.S. Serial No. 08/326,176, filed October 19, 1994 and entitled "Film/Substrate Composite Material" (published as EP 0
707 955 A1 on April 24, 1996), the disclosures of which are hereby incorporated herein by reference. Any such sealant film preferably includes an oxygen-barrier material such as e.g., vinylidene chloride copolymer (saran), nylon, polyethylene terephthalate, ethylene/vinyl alcohol
15 copolymer, etc.

Laminates produced in accordance with the present invention are set forth in the Examples below. For each of the multilayer film and laminate structures shown in the Examples, single slashes (/) indicate an intrafilm layer/layer interface; double slashes (//) indicate an interfilm, i.e., film/film, corona lamination interface; and underlined double slashes (//) indicate a peelable interface. The
20 following resins were employed:

EVA1: Rexene PE 1335, an ethylene vinyl acetate copolymer having 3.3 percent by weight of vinyl acetate, a density of 0.924 g/cc and a 2.0 MI, supplied by Rexene;

EVA2: 98.5% by weight of LD 362, an ethylene vinyl acetate copolymer having in the range
25 of 3.5% to 4.5% by weight of vinyl acetate, a density of 0.925 g/cc and a 2.0 MI (supplied by Exxon), also including 1% by weight of polyethoxylated cetyl alcohol and 0.5% by weight of glycerol monostearate anti-fog additives;

EVA3: 96.5% of Rexene PE 1335, described above, and 3.5% by weight of
30 polyoxyethylene (4) nonylphenol anti-fog additive;

EVA4: Elvax (TM) 3165; an ethylene vinyl acetate copolymer having 18 percent by weight of vinyl acetate, a density of 0.94 g/cc and a 0.7 MI, supplied by DuPont;

EVA5: Exxon 32.89; an ethylene vinyl acetate copolymer having 4% by weight vinyl acetate, supplied by Exxon;

5 LLDPE1: Dowlex 2045.04 (TM), a heterogeneous ethylene octene copolymer having a density of 0.920 g/cc and a 1.0 MI, supplied by the Dow Chemical Co.;

10 LLDPE2: 98.5% by weight of Dowlex 2045.04 (TM), described above, further including 1% by weight of polyethoxylated cetyl alcohol and 0.5% by weight of glycerol monostearate anti-fog additives;

15 LLDPE3: 96.5% by weight of Dowlex 2045.04 (TM), described above, and 3.5% by weight of polyoxyethylene (4) nonylphenol anti-fog additive;

20 LLDPE4: Dowlex 2244A (TM); a heterogeneous ethylene/octene copolymer having a density of 0.916 g/cc and a 3.3 MI, supplied by the Dow Chemical Co.;

25 LMDPE: Dowlex 2037 (TM), a heterogeneous ethylene/octene copolymer having a density of 0.935 g/cc and a 2.5 MI, supplied by the Dow Chemical Co.;

30 Ionomer: Surlyn 1650 (TM), a zinc salt of an ethylene methacrylic acid copolymer, supplied by duPont;

LDPE: NA 345-013, a low density polyethylene having a 1.8 MI, supplied by Quantum;

25 Adh-1: Plexar 107 (TM), an anhydride modified ethylene vinyl acetate copolymer having a 3.2 MI, supplied by Quantum;

30 Adh-2: Bynel CXA-4104 (TM), an anhydride modified linear low density polyethylene having a density of 0.920 g/cc and a 1.0 MI, supplied by duPont;

30 Adh-3: Tymor 1203 (TM), an anhydride-modified linear low density polyethylene; supplied by duPont;

EVOH: Soarnol ET (TM), an ethylene vinyl alcohol copolymer having 38% by mole ethylene and a 3.2 MI, supplied by Nippon Gohsei;

5 Glyc.: a blend of 88% by weight of mono & diglycerides and 12% by weight of propylene glycol;

AB: an antiblock, anhydrous sodium silicate;

10 AB-MB: an antiblock masterbatch, Ampacet 10853, a linear low density polyethylene containing 20% by weight diatomaceous silica having a 1.5 MI;

EMA: EMA 2207, an ethylene methyl acrylate copolymer having 24% by weight of methyl acrylate and a 6.0 MI, supplied by Chevron; and

15 SBC: KK36 (TM) styrene/butadiene copolymer having 75 percent by weight of styrene, a melt index of 8.0 (Condition G of ASTM D-1238) and a density of 1.01 g/cc, obtained from Phillips 66, of Pasadena, Texas.

Example 1

A five layer film having the structure:

20 EVA1 / LLDPE1 / EVA1 / LLDPE1 / EVA1

was coextruded, biaxially oriented, and had a thickness of about 0.6 mil. The final film was subsequently corona treated with an SS155 corona treatment unit from Enercon Industries Corporation at 0.11 kw/in. at 50 ft/min. A sheet of SiO_x coated PET (0.48 mil) was corona treated with the same treatment unit at 0.11 kw/in. at 50 ft/min at the surface containing the SiO_x coating.

25 The corona treated surfaces of the two films were pressed together by a pair of nip rollers to form a laminate having the structure:

PET/ SiO_x // EVA1 / LLDPE1 / EVA1 / LLDPE1 / EVA1.

The laminate was heat-sealed to the flange of a BT979 barrier foam tray (a polystyrene foam tray having an oxygen-barrier sealant film bonded to the upper surface thereof) and then the SiO_x coated PET film was peelably delaminated from the five layer film which remained sealed to the tray.

Example 2

A laminate and package was formed substantially as set forth in Example 1. However, prior to corona treatment, the five layer film was perforated by electrostatic discharge.

Example 3

A laminate was formed substantially as set forth in Example 1. However, the five layer, oriented film employed had the following 0.6 mil structure:

EVA2 / LLDPE2 / EVA2 / LLDPE2 / EVA2

such that the final laminate had the structure:

5 PET/ SiOx // EVA2 / LLDPE2 / EVA2 / LLDPE2 / EVA2.

The laminate was heat-sealed to the flange of a BT979 barrier foam tray and then the SiOx coated PET film was peelably delaminated from the five layer film which remained sealed to the tray.

Example 4

10 A laminate and package was formed substantially as set forth in Example 3. However, prior to corona treatment, the five layer film was perforated by electrostatic discharge.

Example 5

15 A five layer, oriented film as set forth in Example 1 was produced and corona treated at 0.11 kw/in at 50 ft/min on one surface thereof. A five layer, oriented film as set forth in Example 3 was produced, perforated by electrostatic discharge and corona treated at 0.11 kw/in at 50 ft/min on one surface thereof. A sheet of SiOx-coated PET was corona treated on both surfaces thereof with a SS2544 corona treatment unit from Enercon Industries at 0.13 kw/in at 50 ft/min. The three films were simultaneously pressed together by a pair of nip rollers to form a laminate having the structure:

EVA1/LLDPE1/EVA1/LLDPE1/EVA1//SiOx-coated

PET//perforated(EVA2/LLDPE2/EVA2/LLDPE2/EVA2).

20 The laminate was heat-sealed to the flange of a BT979 barrier foam tray and then the SiOx coated PET film and non-perforated film was peelably delaminated (as a two-film laminate) from the perforated five layer film which remained sealed to the tray.

Example 6

25 A five layer, oriented film as set forth in Example 1 was produced and corona treated at 0.13 kw/in at 50 ft/min on both surfaces thereof. A five layer, oriented film as set forth in Example 3 was produced, perforated by electrostatic discharge and corona treated at 0.11 kw/in at 50 ft/min on one surface thereof. A sheet of SiOx-coated PET was corona treated on the SiOx-coated surface thereof at 0.11 kw/in at 50 ft/min. The three films were pressed together by a pair of nip rollers to form a laminate having the structure:

30 PET/ SiOx //EVA1/LLDPE1/EVA1/LLDPE1/

EVA1//Perforated(EVA2/LLDPE2/EVA2/LLDPE2/EVA2).

The laminate was heat-sealed to the flange of a BT979 barrier foam tray and then the SiOx coated PET film and non-perforated film was peelably delaminated (as a two-film laminate) from the perforated five layer film which remained sealed to the tray.

Example 7

A seven layer film was coextruded and hot blown having the 2.0 mil structure:

98% Ionomer + 2% AB-MB/LDPE/Adh-1/EVOH/Adh-1/LDPE/97% EMA + 3% AB-MB.

A five layer film (0.6 mil) was coextruded having the structure:

5 EVA3 / LLDPE3 / EVA3 / LLDPE3 / EVA3

and was biaxially-oriented. The seven layer hot blown film was corona treated on one surface thereof at 0.11 kw/in at 100 ft/min. The five layer oriented film was corona treated on one surface thereof at 0.11 kw/in at 100 ft/min. The corona treated surfaces of the two films were pressed together by a pair of nip rollers to form a laminate having the structure:

10 98% Ionomer + 2% AB-MB/LDPE/Adh-1/EVOH/Adh-1/LDPE/97% EMA + 3% AB-MB//EVA3/LLDPE3/EVA3/LLDPE3/EVA3

The laminate was heat-sealed to the flange of a BT979 barrier foam tray (with EVA3 in contact with the tray) and delaminated at the // interface.

Example 8

15 A two layer film (0.5 mil) was coextruded having the structure:

Adh-2 / 70.5% LLDPE1 + 23.5% LMDPE + 4% Glyc. + 2% AB

and was biaxially-oriented. The two layer film was corona treated on the adhesive surface thereof at 0.11 kw/in at 150 ft/min. A sheet of SiOx-coated PET was corona treated on the SiOx-coated surface thereof at 0.11 kw/in at 150 ft/min. A five layer oriented film as set forth in Example 1 was corona

20 treated at 0.13 kw/in at 150 ft/min on both surfaces thereof. The three films were pressed together by a pair of nip rollers to form a laminate having the structure:

PET/ SiOx //EVA1/LLDPE1/EVA1/LLDPE1/EVA1//Adh-2/70.5% LLDPE1 + 23.5% LMDPE + 4% Glyc. + 2% AB.

The laminate was heat-sealed to the flange of a BT979 barrier foam tray (with the "70.5% LLDPE1 + 23.5% LMDPE + 4% Glyc. + 2% AB" layer in contact with the tray) and delaminated at the // interface.

Example 9

A LLDPE or LDPE biaxially oriented, monolayer intermediate film without anti-fog additive is corona treated on both surfaces thereof and bonded on one surface to a perforated LLDPE or LDPE 30 biaxially oriented, monolayer film containing therein an anti-fog additive (the bonding surface of which is also corona treated), and bonded on the other surface to a sheet of SiOx-coated PET (or PVDC-coated PET), the bonding surface of which is also corona treated, to form the following laminates:

LLDPE + Anti-Fog//LLDPE//SiOx/PET

LDPE + Anti-Fog//LDPE//PVDC/PET

LLDPE + Anti-Fog//LLDPE//PVDC/PET

LDPE + Anti-Fog//LDPE//SiOx/PET

Example 10

A multilayer film with the following construction was hot blown:

5

96% SBC + 4% AB-MB/EVA4/Adh-3/EVOH/Adh-3/EVA5

This film was corona laminated to a sheet of oriented polypropylene (440 CGW from Norprop) to form a lidstock with the SBC on the side to be in contact with the permeable film 10 (Example 12), while having a high- temperature-resistant material (oriented PP) on the side contacting the heat-seal bar.

Example 11

A multilayer film with the following construction was hot blown:

96% SBC+4% AFOG/96% EVA4/Adh-3/EVOH/Adh-3/EVA5+4% AFOG

15

This film was corona laminated to a sheet of oriented polypropylene (440 CGW from Norprop) to form a lidstock with the SBC on the side to be in contact with the permeable film (Example 12), while having a high- temperature-resistant material (oriented PP) on the side 20 contacting the heat-seal bar ("AFOG" is polyoxyethylene (4) nonylphenol anti-fog additive).

Example 12

20

A coextruded, biaxially oriented multilayer film had the following construction:

SBC/ULDPE/EVA4/ULDPE/LLDPE4

This film was corona-laminated to the films of Examples 10 and 11 to produce peelable laminates of the following constructions ("ULDPE" is XU 61521 ultra low density polyethylene from Dow):

25

LLDPE4/ULDPE/EVA4/ULDPE/SBC//96% SBC+4%AB-MB/EVA4/
Adh-3/EVOH/Adh-3/EVA5//Oriented PP

LLDPE4/ULDPE/EVA4/ULDPE/SBC//96% SBC+4% AFOG/EVA4+4% AFOG/Adh-
3/EVOH/Adh-3/EVA5//Oriented PP

30

The foregoing laminates were heat-sealed to the flange of a BT979 barrier foam tray (with the "LLDPE4 layer in contact with the tray) and delaminated at the // interface, i.e., the lidstock separated at the junction of the two SBC materials.

35

The foregoing description of preferred embodiments of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and modifications and variations are possible in light of the above teachings or may be acquired from practice of the invention. The embodiments were chosen and described in

order to explain the principles of the invention and its practical application to enable one skilled in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto, and their equivalents.

WHAT IS CLAIMED IS:

1. A package, comprising:
 - a product support member having a cavity formed therein, a product being disposed with
5 said cavity;
 - a laminate heat-sealed to the support member and enclosing the product therein, said laminate comprising a first film in contact with said support member and a second film, at least one of said first and second films comprising a reactively-modified surface such that said laminate peelably delaminates at a peel force ranging from 0.001 pounds per inch to 2.5 pounds per inch.
- 10 2. The package set forth in claim 1 wherein the first film is gas-permeable.
3. The package set forth in claim 2 wherein said gas-permeable film is perforated.
- 15 4. The package set forth in claim 1 wherein said first film is rendered gas-permeable by perforating said film.
5. The package set forth in claim 1 wherein said first and second films are in direct contact with one another and define an interface therebetween, said at least one corona-treated surface being
20 located at said interface.
6. The package set forth in claim 5 wherein said first and second films are stretch-oriented films, each of said films comprising a polyolefin at said interface.
- 25 7. The package set forth in claim 5 wherein at least one of said first and second films are not stretch-oriented and comprise at least one material selected from the group consisting of ethylene/vinyl acetate copolymer (EVA), ethylene/methacrylate copolymer (EMA), acrylic acid copolymers, methyl acrylic acid copolymers, acrylic acid-modified EVA or EMA, anhydride-modified EVA or EMA, and syndiotactic polymethyl pentene at said interface.
- 30 8. The package set forth in claim 5 wherein said first and second films each comprise styrene/butadiene copolymer at said interface.

9. The package set forth in claim 1, further including an intermediate film positioned between said first and second films, said first and intermediate films being in direct contact with one another and defining an interface therebetween, at least one of said first and intermediate films having a corona-treated surface located at said interface.

5

10. The package set forth in claim 9 wherein said first film contains therein an anti-fog additive and said intermediate film contains substantially no anti-fog additive.

11. The package set forth in claim 9 wherein said first and intermediate films are stretch-oriented films, each of said films comprising a polyolefin at said interface.

12. The package set forth in claim 9 wherein at least one of said first and intermediate films are not stretch-oriented and comprise at least one material selected from the group consisting of ethylene/vinyl acetate copolymer (EVA), ethylene/methacrylate copolymer (EMA), acrylic acid copolymers, methyl acrylic acid copolymers, acrylic acid-modified EVA or EMA, anhydride-modified EVA or EMA, and syndiotactic polymethyl pentene at said interface.

13. The package set forth in claim 9 wherein said first and intermediate films each comprise styrene/butadiene copolymer at said interface.

20

14. The package set forth in claim 1 wherein said second film is substantially gas-impermeable.

15. The package set forth in claim 14 wherein said substantially gas-impermeable film comprises at least one material selected from the group consisting of ethylene/vinyl alcohol copolymers, polyamides, vinylidene chloride copolymers, biaxially oriented nylon, biaxially oriented polyester, polyethylene terephthalate, and silicon oxide.

16. The package set forth in claim 1 wherein said reactively-modified surface is a corona-treated surface.

17. A method for making a package for a product comprising:
providing a product support member containing a product therein;
providing a first film;

providing a second film;

reactively modifying the surface of at least one of said first and second films to form a reactively-modified surface and pressing the first and second films together, thereby forming a laminate which is delaminatable at a peel force ranging from 0.001 pounds per inch to 2.5 pounds per

5
inch;

extending the laminate over the support member containing the product such that the first film is adjacent to the support member; and

sealing the laminate to the support member.

10 18. A method as set forth in claim 17 further including the step of perforating the first film prior to pressing the first and second films together.

19. A method as set forth in claim 17 wherein said first film is a gas-permeable film.

15 20. A method as set forth in claim 17 wherein said step of sealing the laminate to the support member seals the first film portion thereof to the support member and peelably seals the second film portion to the first film portion.

20 21. A method as set forth in claim 17 further including the step of heating the first and second films substantially simultaneously with the step of pressing the first and second films together.

22. A method as set forth in claim 18 wherein the step of perforating the first film comprises electrostatically microperforating the first film.

25 23. The method set forth in claim 17 wherein said first and second films are in direct contact with one another and define an interface therebetween, said at least one corona-treated surface being located at said interface.

30 24. The method set forth in claim 23 wherein said first and second films are stretch-oriented films, each of said films comprising a polyolefin at said interface.

25. The method set forth in claim 23 wherein at least one of said first and second films are not stretch-oriented and comprise at least one material selected from the group consisting of ethylene/vinyl acetate copolymer (EVA), ethylene/methacrylate copolymer (EMA), acrylic acid

copolymers, methyl acrylic acid copolymers, acrylic acid-modified EVA or EMA, anhydride-modified EVA or EMA, and syndiotactic polymethyl pentene at said interface.

26. The method set forth in claim 23 wherein said first and second films each comprise
5 styrene/butadiene copolymer at said interface.

27. The method set forth in claim 17, further including an intermediate film positioned
between said first and second films, said first and intermediate films being in direct contact with one
another and defining an interface therebetween, at least one of said first and intermediate films having
10 a corona-treated surface located at said interface.

28. The method set forth in claim 27 wherein said first film contains therein and anti-fog
additive and said intermediate film contains substantially no anti-fog additive.

15 29. The method set forth in claim 27 wherein said first and intermediate films are stretch-
oriented films, each of said films comprising a polyolefin at said interface.

30. The method set forth in claim 27 wherein at least one of said first and intermediate films
are not stretch-oriented and comprise at least one material selected from the group consisting of
20 ethylene/vinyl acetate copolymer (EVA), ethylene/methacrylate copolymer (EMA), acrylic acid
copolymers, methyl acrylic acid copolymers, acrylic acid-modified EVA or EMA, anhydride-modified
EVA or EMA, and syndiotactic polymethyl pentene at said interface.

31. The method set forth in claim 27 wherein said first and intermediate films each comprise
25 styrene/butadiene copolymer at said interface.

32. The method set forth in claim 16 wherein said second film is substantially gas-
impermeable.

30 33. The method set forth in claim 32 wherein said substantially gas-impermeable film
comprises at least one material selected from the group consisting of ethylene/vinyl alcohol
copolymers, polyamides, vinylidene chloride copolymers, biaxially oriented nylon, biaxially oriented
polyester, polyethylene terephthalate, and silicon oxide.

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34. The method set forth in claim 17 wherein said reactively-modified surface is a corona-treated surface.

1/3

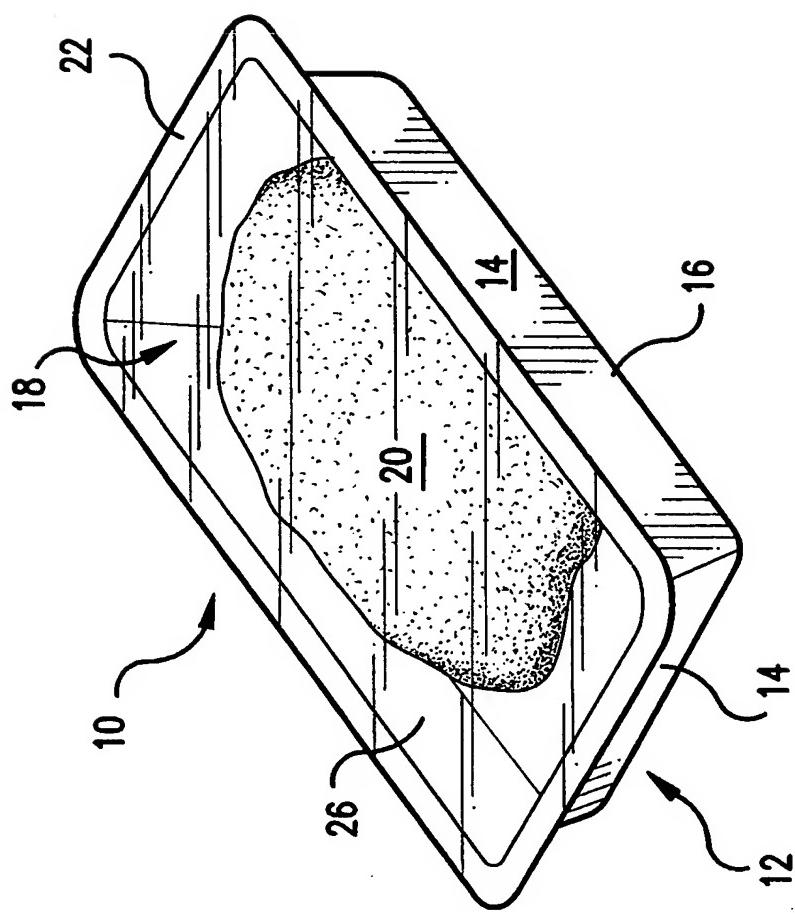


FIG. 1

2/3

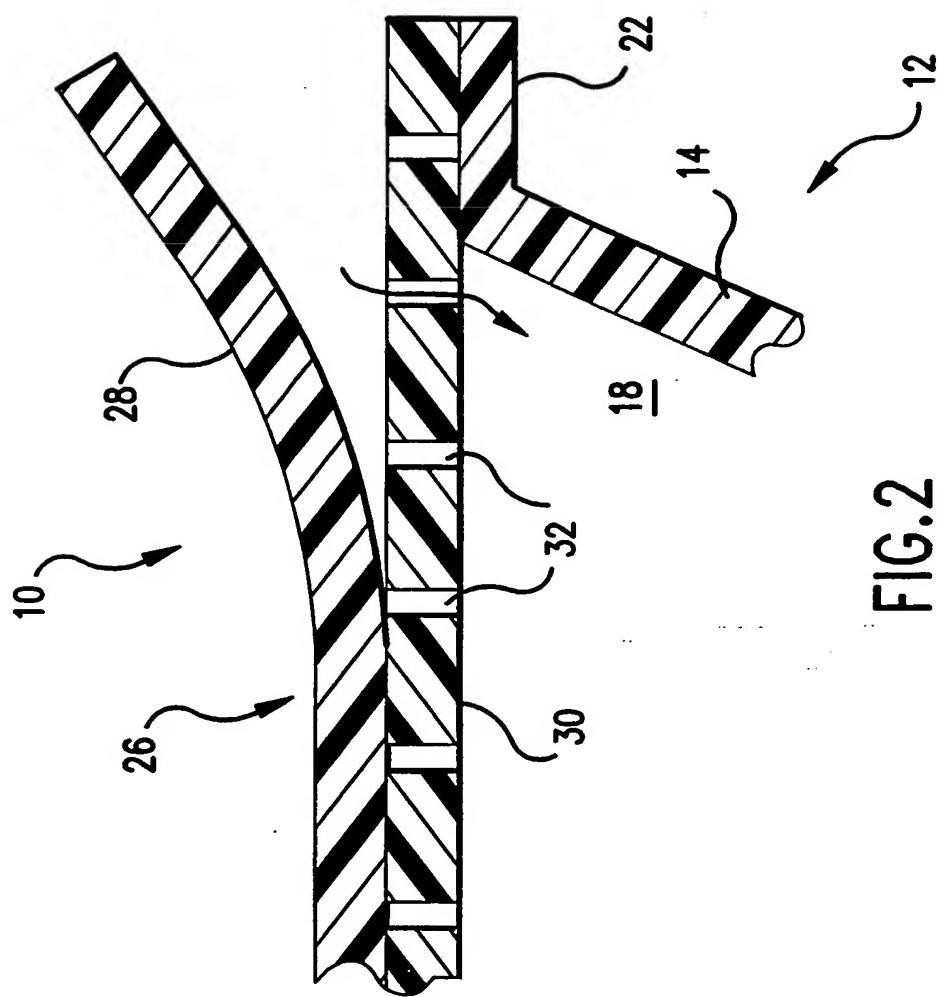


FIG. 2

3/3

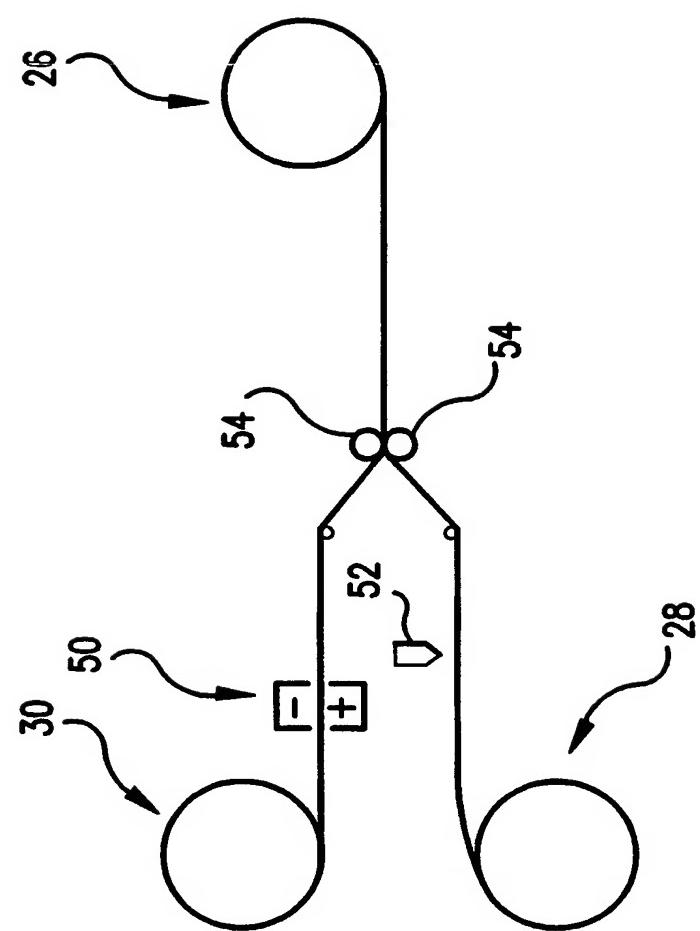


FIG.3

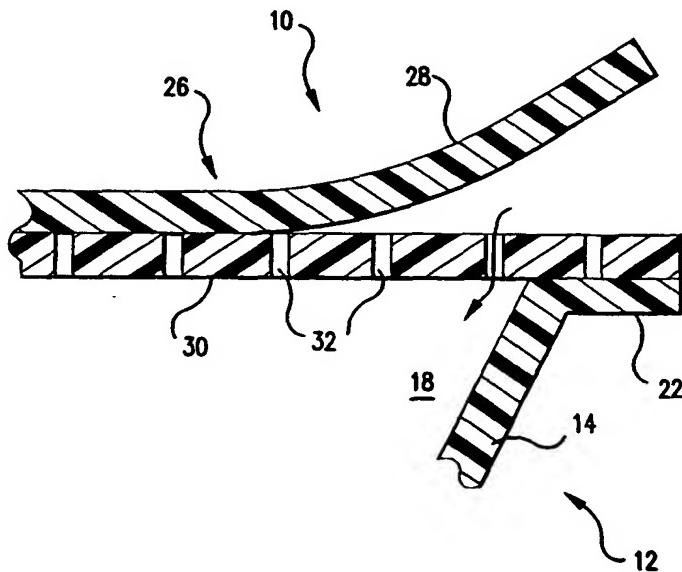


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(71) Applicant (for all designated States except US):	CRYOVAC, INC. [US/US]; P.O. Box 464, Duncan, SC 29334-0464 (US).		
(72) Inventors; and		Published	
(75) Inventors/Applicants (for US only):	BARMORE, Charles, R. [-/US]; 113 Cumberland Road, Moore, SC 29369 (US). LUTHRA, Narender, P. [-/US]; 58 Deer Track, Simpsonville, SC 29681 (US). MUELLER, Walter, B. [-/US]; 280 Bertha Burns Road, Inman, SC 29349 (US). OWENSBY, Joseph, E. [-/US]; 335 Seven Oaks Lane, Spartanburg, SC 29301 (US).	With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.	
(74) Agents:	LAGALY, Thomas, C. et al.; 100 Rogers Bridge Road, P.O. Box 464, Duncan, SC 29334 (US).	(88) Date of publication of the international search report:	3 September 1998 (03.09.98)

(54) Title: PACKAGE HAVING A MULTIPLE-FILM LID COMPRISING A GAS-IMPERMEABLE FILM PEELABLY ADHERED TO A GAS-PERMEABLE FILM



(57) Abstract

A method and package which allows for butchering and packaging of fresh red meat at a centralized facility is provided. The package (10) includes a substantially gas-impermeable tray (12) supporting a product, a first permeable and/or perforated film (30) sealed to the tray for enclosing the product, and a second substantially gas-impermeable film (28) enclosing the first film (30), such that removal of said substantially gas-impermeable film (28) provides for the exchange of gases into and out of the package. One of either the first (30) or second (28) films has been corona treated and the two films are pressed together to form a laminate (26). The laminate (30) is sealed to the tray (12) such that the first film (30) is sealed to the tray (12) and the second film (28) is peelably sealed to the first film (30).

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International Application No

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	EP 0 769 454 A (GRACE W R & CO) 23 April 1997 see claims 1,12 see column 7, line 1 - column 8, line 58 ---	1,2,14, 15,17, 19,20, 32,33
P,X	WO 96 39341 A (GRACE W R & CO) 12 December 1996 see page 6, line 16 - page 10, line 33 see page 11, line 35 - page 13, line 3 ---	1-4,9, 14,15
P,A		17
X	EP 0 698 563 A (GRACE W R & CO) 28 February 1996 see claims 1-3,11,12 see column 3, line 23 - column 7, line 35 ---	1-4,9, 14,15
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Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 96 15903 A (GRACE W R & CO) 30 May 1996 see claims -----	5
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Information on patent family members

International Application No

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